L-VRAP: a Lunar Volatile Resource Analysis Package for in-situ determination of lunar polar ices

Conference or Workshop Item

EPSC Abstracts
Vol. 9, EPSC2014-841, 2014
European Planetary Science Congress 2014

L-VRAP: a Lunar Volatile Resource Analysis Package for in-situ determination of lunar polar ices

SJ Barber[1], J Carpenter[2], M Anand[1], GH Morgan[1], AD Morse[1], S Sheridan[1], IP Wright[1]

[1]The Open University, Milton Keynes, UK

[2]ESA ESTEC, Keplerlaan 1, 2201AZ, Noordwijk, The Netherlands

simeon.barber@open.ac.uk

As evidence from both orbital and sample return data (refs) mounts for substantial quantities of volatiles trapped in lunar polar regions, there is a need to answer such questions as (a) what volatiles are present; (b) in what physical, chemical and isotopic forms; (c) in what quantities; (d) what are their sources, evolution and sinks on the Moon in the context of the Solar System inventory and (e) can they be extracted for in-situ resource utilisation (ISRU)?

L-VRAP was conceived to address these questions and more, and would be the adjunct to a highly capable sample extraction and handling system that could first extract samples from targeted localities such as shaded areas and from depth and then could deliver these to L-VRAP with minimal alteration.

Volatiles would be released within L-VRAP by thermo-chemical processing, including pyrolysis, combustion or reduction, and would be quantified and characterised in a mass spectrometer capable of determination of stable isotopic compositions with geological precision. This would enable comparison with datasets from terrestrial stable isotope laboratories and from other space missions e.g. Rosetta, and would inform the planning of lunar polar sample return missions and ultimately potential extended human exploration on the Moon.

The current status of the L-VRAP concept, which has been developed under funding from the European Space Agency, will be described. Some of the requirements that are necessary of a sample system that must extract, handle and deliver to analysis packages potentially ice-rich cryogenic whilst maintaining sample integrity will be addressed. Finally the potential of the package to provide ground truth for orbital instruments and analysis of returned samples will be considered.